ETRX358x-LRS ZIGBEE® MODULES

PRODUCT MANUAL

Preliminary

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Image not shown actual size; enlarged to show detail.

The Telegesis ETRX358x-LRS and ETRX358xHR-LRS modules are low power 2.4GHz ZigBee modules with an added frontend module (SiGe SE2432L) containing both PA and LNA for highest possible link budget.

Based on the latest Ember EM358x family of single chip ZigBee solutions the new long range modules are footprint compatible with the entire Telegesis ETRX3 family, thus representing a drop-in replacement for all applications where a high link budget is required.

The module's unique AT-style command line interface allows designers to quickly integrate ZigBee technology without complex software engineering. For custom application development the ETRX358x series integrates with ease into Ember's InSight development environment.

Module Features

- Small form factor, SMT module 25mm x 19mm
- Same footprint and pin-out as ETRX357-LRS
- Side Castellations for easy soldering and inspection
- Two antenna options: Integrated chip antenna or U.FL coaxial connector
- Based on 32-bit ARM® Cortex-M3
- Industry standard JTAG Programming and real time network level debugging via the Ember Debug Port
- Up to 512kB of flash and 64kbytes of RAM
- Lowest Deep Sleep Current of 1µA with retained RAM and GPIO and multiple sleep modes
- Ultra Wide supply voltage range (2.1 to 3.6V)
- Optional 32.768kHz watch crystal can be added externally
- Module ships with standard Telegesis AT-style command interface based on the ZigBee PRO feature set
- Can act as an End Device, Router or Coordinator
- 22 general-purpose I/O lines including analogue inputs
- Firmware upgrades via serial port or over the air (password protected)
- Hardware supported encryption (AES-128)
- CE and FCC and IC compliance, FCC modular approval
- Operating temperature range: -40˚C to +85˚C
- Standard version without LNA and PA available in the same form factor

Radio Features

- Based on the Silicon Labs EM358x family of single chip ZigBee® SoCs
- 2.4GHz ISM Band
- 250kbit/s over the air data rate – NB: actual usable data throughput with ZigBee is about 20kbps
- 15 channels (IEEE802.15.4 Channel 11 to 25)
- SiGe SE2432L integrated PA and LNA
- +20dBm output power (adjustable down to -41dBm)
- High sensitivity of -106dBm typ. @ 1% packet error rate
- RX Current: 33mA, TX Current: approx 140mA at 20dBm

Suggested Applications

- ZigBee Smart Energy applications
- Wireless Alarms and Security
- Home/Building Automation
- Wireless Sensor Networks
- M2M Industrial Controls
- Lighting and ventilation control
- Remote monitoring
- Environmental monitoring and control

Development Kit

- New Development kit containing everything required to set up a mesh network quickly and evaluate range and performance of the ETRX358x and its long range version.
- AT-style software interface command dictionary can be modified for high volume customers.
- Custom software development available upon request.

Example AT-Style Commands

AT+BCAST	Send a Broadcast
AT+UCAST:<address>	Send a Unicast
AT+EN	Establish PAN network
AT+JN	Join PAN

At power-up the last configuration is loaded from non-volatile S-Registers, which can eliminate the need for an additional host controller.

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1 Introduction

This document describes the Telegesis ETRX358x-LRS and ETRX358xHR-LRS ZigBee long range modules which have been designed to be easily integrated into another device and to provide a fast, simple and low cost wireless mesh networking interface.

The Telegesis ETRX3 series modules are based on the Silicon Labs ZigBee compliant platform consisting of the single chip family of EM358x SoCs combined with the ZigBee PRO compliant EmberZNet meshing stack. Integration into a wide range of applications is made easy using a simple AT style command interface and advanced hardware design.

The configurable functionality of the Telegesis AT Commandset often allows the ETRX3 series ZigBee modules to be used without an additional host microcontroller saving even more integration time and costs. In addition to the Telegesis AT Commandset, the ETRX358x-LRS and ETRX358xHR-LRS modules can be used with custom-built firmware whilst representing an ideal platform for custom firmware development in conjunction with the Silicon Labs ZigBee development kits.

No RF experience or expertise is required to add this powerful wireless networking capability to your products. The ETRX358x-LRS and ETRX358xHR-LRS offer fast integration opportunities and the shortest possible time to market for your product.

1.1 Hardware Description

The main building blocks of the ETRX358x-LRS and ETRX358xHR-LRS are the single chip EM358x SoC from Silicon Labs, a SiGe SE2432L frontend module combining a Power Amplifier with a Low Noise Amplifier, a 24MHz reference crystal and RF front-end circuitry optimized for best RF performance. The modules are available with on-board antenna or alternatively a U.FL connector for attaching external antennae. Modules with the U.FL connector are identified by the “HR” suffix.

The integrated antenna is an Antenova Rufa, and details of the radiation pattern etc are available from the Antenova website [5].

Module	Chip	Flash	RAM	Antenna	USB
ETRX3581-LRS[1]	EM3581	256kB	32kB	Chip	No
ETRX3581HR-LRS [1]	EM3581	256kB	32kB	External	No
ETRX3582-LRS [1]	EM3582	256kB	32kB	Chip	Yes
ETRX3582HR-LRS [1]	EM3582	256kB	32kB	External	Yes
ETRX3585-LRS [1]	EM3585	512kB	32kB	Chip	No
ETRX3585HR-LRS [1]	EM3585	512kB	32kB	External	No
ETRX3586-LRS [1]	EM3586	512kB	32kB	Chip	Yes
ETRX3586HR-LRS [1]	EM3586	512kB	32kB	External	Yes
ETRX3587-LRS	**EM3587**	**512kB**	**64kB**	**Chip**	**No**
ETRX3587HR-LRS	**EM3587**	**512kB**	**64kB**	**External**	**No**
ETRX3588-LRS [1]	EM3588	512kB	64kB	Chip	Yes
ETRX3588HR[1]	EM3588	512kB	64kB	External	Yes

Table 1: Memories

[1] MOQ and Lead Time applies. Only stocked modules are ETRX3587 and ETRX3587HR

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The LNA and RF power amplifier of the LRS devices improve the output power by 12dB and the sensitivity by 5dB which will increase the range by approximately 700% relative to the standard devices (where local regulations permit the use of the maximum output power).

The ETRX358x and ETRX358xHR are used for ZigBee (www.zigbee.org) applications. In case it is desired to develop custom firmware instead of using the pre-loaded AT-Command interface, the Silicon Labs toolchain, consisting of Ember Desktop together with a comprehensive integrated development environment (IDE), is required.

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2 Product Approvals

The ETRX358x-LRS and ETRX358xHR-LRS have been designed to meet all national regulations for world-wide use. In particular the following certifications have been obtained:

2.1 FCC Approvals

The Telegesis ETRX358x-LRS family integrated Antenna as well as the ETRX358xHR-LRS family including the antennas listed in

Item	Part No.	Manufacturer	Type	Impedance	Gain
1	BT-Stubby (straight)	EAD Ltd. [6]	¼ Wave	50Ω	0dBi
2	BT-Stubby (right-angle)	EAD Ltd. [6]	¼ Wave	50Ω	0dBi
3	CJ-2400-6603	Chang Jia	½ Wave	50 Ω	2.0dBi
4	Rufa (on board)	Antenova	Chip	50Ω	2.1dBi (peak)

Table 2 and the power levels listed in section 10.2 have been tested to comply with FCC CFR Part 15 (USA) The devices meet the requirements for modular transmitter approval as detailed in the FCC public notice DA00.1407.transmitter. FCC statement:

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC ID: S4GEM358L

This module complies with the USA SAR requirements and is not intended to be operated within 20cm of the body. The following statement must be included as a CAUTION statement in manuals for OEM products to alert users on FCC RF exposure compliance

"WARNING: To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20cm or more should be maintained between the antenna of this device and persons during operation. To ensure compliance, operations at closer distances than this are not recommended."

Item	Part No.	Manufacturer	Type	Impedance	Gain
1	BT-Stubby (straight)	EAD Ltd. [6]	¼ Wave	50Ω	0dBi
2	BT-Stubby (right-angle)	EAD Ltd. [6]	¼ Wave	50Ω	0dBi
3	CJ-2400-6603	Chang Jia	½ Wave	50 Ω	2.0dBi
4	Rufa (on board)	Antenova	Chip	50Ω	2.1dBi (peak)

Table 2. Approved Antennae

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An end user deploying an ETRX358x-LRS or an ETRX358xHR-LRS module together with an antenna as listed in Table 2 is not required to obtain a new authorization for the module – BUT this does not preclude the possibility that some other form of authorization or testing may be required for the end product depending upon local territorial regulations.

The FCC requires the user to be notified that any changes or modifications made to this device that are not expressly approved by Telegesis (UK) Ltd. may void the user's authority to operate the equipment.

When using the ETRX358x-LRS with approved antennae, it is required to prevent end-users from replacing them with non-approved ones.

2.1.1 FCC Labelling Requirements

When integrating the ETRX358x-LRS or ETRX358xHR-LRS families into a product it must be ensured that the FCC labelling requirements are met. This includes a clearly visible label on the outside of the finished product specifying the Telegesis FCC identifier (**FCC ID: S4GEM358L**) as well as the notice above. This exterior label can use wording such as **"Contains Transmitter Module FCC ID: S4GEM358L"** or **"Contains FCC ID: S4GEM358L"** although any similar wording that expresses the same meaning may be used.

2.2 IC (Industry Canada) Approvals

The Telegesis ETRX358x-LRS family with integrated Antenna as well as the ETRX358xHR-LRS family have been approved by Industry Canada to operate with the antenna types listed in Table 2 with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

IC-ID: 8735A-EM358L

- This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
- Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.
- To comply with Industry Canada RF radiation exposure limits for general population, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times and must not be co-located or operating in conjunction with any other antenna or transmitter.
- This device has been designed to operate with the antennas listed in Table 2, and having a maximum gain of 2.1 dBi. Antennas not included in this list or having a gain greater than 2.1

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dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

OEM Responsibilities

The ETRX358x-LRS and ETRX358x-LRS families of module have been certified for integration into products only by OEM integrators under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance of 0.75cm is maintained between the radiator (antenna) and all persons at all times.
2. The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

As long as the two conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE: In the event that these conditions can not be met (for certain configurations or co-location with another transmitter), then Industry Canada certification is no longer considered valid and the IC Certification Number can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Industry Canada authorization.

2.2.1 IC Labelling Requirements

The ETRX358x-LRS and ETRX358xHR-LRS family modules are labelled with its own IC Certification Number. If the IC Certification Number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labelled in a visible area with the following:

"**Contains Transmitter Module IC: 8735A-EM358L**
or
"**Contains IC: 8735A-EM358L**

The OEM of the ETRX358x-LRS and ETRX358xHR-LRS family modules must only use the approved antenna(s) listed above, which have been certified with this module.

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user's manual of the end product.

The user's manual for the end product must include the following information in a prominent location:

"To comply with Industry Canada RF radiation exposure limits for general population, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times and must not be co-located or operating in conjunction with any other antenna or transmitter."

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2.3 European Certification

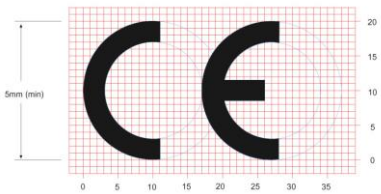
The ETRX358x and ETRX358xHR families are at a maximum power level of 21.15mW e.i.r.p. (13.2dBm) compliant to the following standards:

- Radio: EN 300 328:V1.7.1
- EMC: EN 301 489-17:V2.2.1
- Safety: EN 60950-1:2006/A12:2011

All tests have been conducted with the antennae listed in Table 2.

If the ETRX358x-LRS and ETRX358xHR-LRS families of modules are incorporated into an OEM product, the OEM product manufacturer must ensure compliance of the final product to the European Harmonised EMC, and low voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in the R&TTE Directive. The final product must not exceed the specified power ratings, antenna specifications and installation requirements as specified in this user manual. If any of these specifications are exceeded in the final product then a submission must be made to a notified body for compliance testing to all of the required standards.

The 'CE' marking must be applied to a visible location on any OEM product. For more information please refer to http://ec.europa.eu/enterprise/faq/ce-mark.htm. Customers assume full responsibility for learning and meeting the required guidelines for each country in their distribution market.



2.4 Declarations of Conformity

Telegesis (UK) Ltd has issued Declarations of Conformity for all ETRX3 series ZigBee RF Modules, which cover Radio Emissions, EMC and Safety. These documents will be available from our website or on request

2.5 IEEE 802.15.4

IEEE 802.15.4 is a standard for low data rate, wireless networks (raw bit-rate within a radio packet of 250kbps @2.4GHz) which focuses on low cost, low duty cycle, long primary battery life applications as well as mains-powered applications. It is the basis for the open ZigBee Protocol.

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2.6 The ZigBee Protocol

The ZigBee Protocol is a set of standards for wireless connectivity for use between any devices over short to medium distances. The specification was originally ratified in December 2004, paving the way for companies to start making low-power networks a reality.

ZigBee uses an IEEE 802.15.4 radio specification running on the 2.4GHz band, plus three additional layers for networking, security and applications. What makes the specification unique is its use of a mesh network architecture which, in bucket chain style, passes data from one node to the next until it lands at its destination. The network is self-healing and adapts its routing as link quality changes or nodes move. Furthermore, nodes can be defined as End Devices which do not act as routers, but can therefore be put into a low-power sleep state.

The enhanced version of the ZigBee standard (or ZigBee 2006) was released in December 2006, adding new features and improvements to the only global wireless communication standard enabling the development of easily deployable low-cost, low-power, monitoring and control products for homes, commercial buildings and industrial plant monitoring. In 2007 the ZigBee Alliance introduced the PRO feature-set which offers advantages over earlier feature-sets, including

- Truly self-healing mesh networking
- Messages can now travel up to 30 hops
- Source-Routing for improved point to multipoint message transmission
- Improved security including Trust-Centre link keys
- New message types and options

The Telegesis AT Command-set, which by default ships on all ETRX3 series products is based on the ZigBee PRO feature-set. For more information on the Telegesis AT Command-set please refer to the separate documentation at www.telegesis.com.

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3 Module Pinout

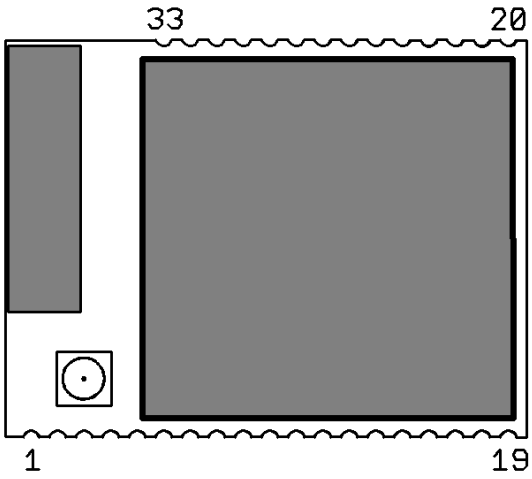

Figure 1. ETRX3 series Module Pinout (top view)

The table below gives details about the pin assignment for direct SMD soldering of the ETRX3 series modules to the application board. For more information on the alternate functions please refer to [2]. Also refer to the Telegesis AT Command-set documentation to understand how the pre-programmed firmware makes use of the individual I/Os.

All GND pads are connected within the module, but for best RF performance all of them should be grounded externally.

ETRX358x pad	Name	Default Use	Alternate function	EM35x pin	Alternate functions
1	GND	GND		GND	
2	TX_ACTIVE{1}	I/O		11	TX_ACTIVE. PC5 of the EM35x is used to control the FEM
3	PC6	I/O		13	OSC32B, nTX_ACTIVE
4	PC7	I/O		14	OSC32A, OSC32_EXT
5	PA7 {5}	I/O		18	TIM1C4
6	PB3 {2,3}	I/O	CTS	19	SC1nCTS, SC1SCLK, TIM2C3
7	nReset {5}	nReset		12	
8	PB4 {2}	I/O	RTS	20	TIM2C4, SC1nRTS, SC1nSSEL
9	PA0	I/O		21	TIM2C1, SC2MOS,USBDM{7}I
10	PA1	I/O		22	TIM2C3, SC2SDA, SC2MISO,USBDP{7}
11	PA2	I/O		24	TIM2C4, SC2SCL, SC2SCLK
12	PA3	I/O		25	SC2nSSEL, TRACECLK, TIM2C2
13	GND	GND		GND	
14	PA4	I/O		26	ADC4, PTI_EN, TRACEDATA
15	PA5 {4}	I/O		27	ADC5, PTI_DATA, nBOOTMODE, TRACEDATA3
16	PA6 {5}	I/O		29	TIM1C3
17	PB1{3}	TXD		30	SC1MISO, SC1MOSI, SC1SDA, SC1TXD, TIM2C1
18	PB2{3}	RXD		31	SC1MISO, SC1MOSI, SC1SCL, SC1RXD, TIM2C2

ETRX358x pad	Name	Default Use	Alternate function	EM35x pin	Alternate functions
19	GND	GND		GND	
20	GND	GND		GND	
21	JTCK	JTCK		32	SWCLK
22	PC2	I/O		33	JTDO, SWO
23	PC3	I/O		34	JTDI
24	PC4	I/O		35	JTMS, SWDIO
25	N/C{1}	N/C		36	PB0 of the EM35x is used to control the FEM
26	PC1	I/O	ADC3	38	ADC3, SWO, TRACEDATA0
27	PC0 {5}	I/O		40	JRST, IRQD, TRACEDATA1
28	PB7 {5}	I/O	ADC2	41	ADC2, IRQC, TIM1C2
29	PB6 {5}	I/O	ADC1	42	ADC1, IRQB, TIM1C1
30	PB5	I/O	ADC0	43	ADC0, TIM2CLK, TIM1MSK
31	GND	GND		GND	
32	Vcc	Vcc		Vcc	
33	GND	GND		GND	

Table 3. Pin Information

Notes:

{1} Pins PB0 and PC5 of the EM357 are used internally to control the front-end module. PB0 is not available to the user.

{2} The serial UART connections TXD, RXD, CTS and RTS are PB1, PB2, PB3 and PB4 respectively

{3} When using the Telegesis AT Command-set, RTS/CTS handshaking is selectable in firmware. See the AT Command Manual.

{4} If PA5 is driven low at power-up or reset the module will boot up in the bootloader

{5} PA6, PA7, PB6, PB7 and PC0 can drive high current (see section 8)

{6} nRESET is level-sensitive, not edge-sensitive. The module is held in the reset state while nRESET is low. This signal has a 30kΩ Pull-Up.

{7} ETRX3588, ETRX3586, ETRX3582 and ETRX3588HR, ETRX3586HR, ETRX3582HR variants only

Alternate functions depend on the firmware, but the Telegesis R3xx AT Command-set functions are indicated here for convenience.

Important Note: The ETRX358x series and the ETRX358x-LRS series of modules are footprint compatible, but on the ETRX358x-LRS series pins PB0 and PC5 of the EM358x are used internally to control the front-end module and are not available to the user. PC5 is still available on Pad2, but it is configured as TX_ACTIVE signal and cannot be used as a general purpose GPIO.

See also the table “Module pads and functions” in the ETRX357 Development Kit Product Manual. Refer to the Silicon Labs EM358x manual for details of the alternate functions and pin names.

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4 Hardware Description

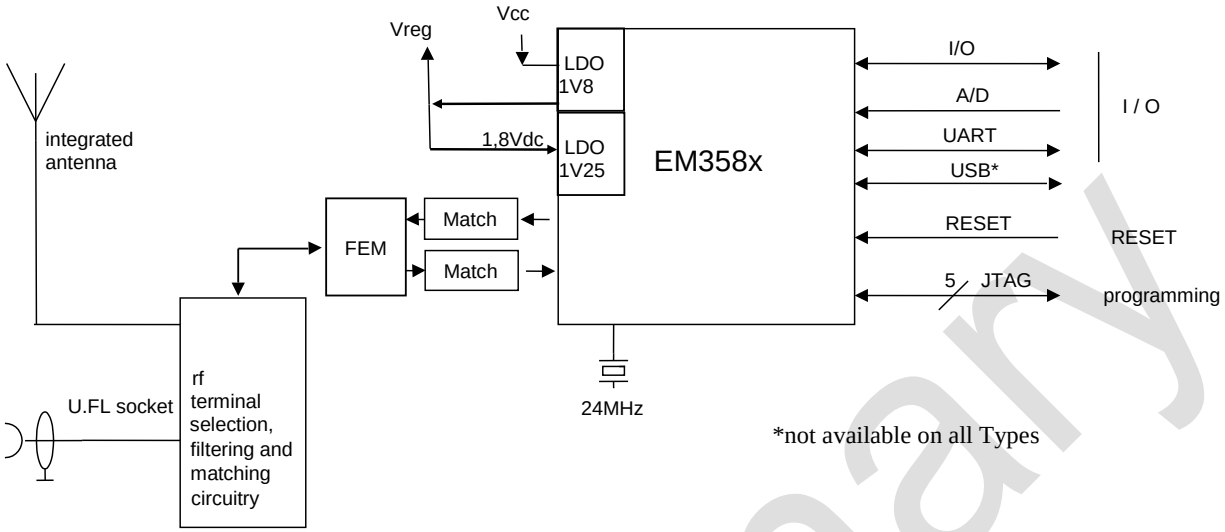

Figure 2. Hardware Diagram

The ETRX358x-LRS and ETRX358x-LRS are based on the Silicon Labs EM358x family of ZigBee SoCs in addition to a frontend module containing a PA, LNA and RF switch in addition to the RF-frontend circuitry. The EM358x family of ZigBee SoCs are fully integrated 2.4GHz ZigBee transceivers with a 32-bit ARM® Cortex M3™ microprocessor, flash and RAM memory, and peripherals.

The industry standard serial wire and JTAG programming and debugging interfaces together with the standard ARM system debug components help to streamline any custom software development.

In addition to this a number of MAC functions are also implemented in hardware to help maintain the strict timing requirements imposed by the ZigBee and IEEE802.15.4 standards.

The new advanced power management features allow faster wakeup from sleep and new power-down modes allow this 3rd generation module to offer a longer battery life than any 2nd generation modules on the market.

The EM358x has fully integrated voltage regulators for both required 1.8V and 1.25V supply voltages. The voltages are monitored (brown-out detection) and the built in power-on-reset circuit eliminates the need for any external monitoring circuitry. A 32.768kHz watch crystal can be connected externally to pads 3 and 4 in case more accurate timing is required.

4.1 Hardware Interface

All GPIO pins of the EM358x chips are accessible on the module's pads. Whether signals are used as general purpose I/Os, or assigned to a peripheral function like ADC is set by the firmware. When using the Telegesis AT Commandset please refer to the AT Commandset manual and the development kit manual for this information and when developing custom firmware please refer to the EM358x datasheet [2].

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5 Firmware Description

By default, the modules will be pre-loaded with a standalone bootloader which supports over-the-air bootloading as well as serial bootloading of new firmware.

In order to enter the standalone bootloader using a hardware trigger pull PA5 to ground and power-cycle or reset the module. To avoid entering the standalone bootloader unintentionally make sure not to pull this pin down during boot-up unless the resistance to ground is >10kΩ. (A pull-up is not required).

In addition to the standalone bootloader the modules also contain the current release of the Telegesis AT-style command interface as described in the Telegesis AT command dictionary and the Telegesis user guide. Check www.telegesis.com for updates. Each module comes with a unique 64-bit 802.15.4 identifier which is stored in non-volatile memory. The commands and responses pass through the serial port of the ETRX358x as ASCII text, so a simple terminal application will usually suffice. We provide Telegesis Terminal for interaction with the module but it is not an essential feature.

The pre-loaded AT-style command interface firmware is based on the latest EmberZNet PRO meshing stack which implements routers/coordinators as well as (sleepy) end devices. [End devices have no routing responsibility and therefore are allowed to go to sleep, whilst still being able to send and receive messages via a parent router. In addition to classical sleepy and non-sleepy end devices the module firmware also supports mobile (sleepy) end devices capable of changing their parent quickly whenever they change their position within the network.]

A router is typically a mains powered device whilst a sleepy end device (SED) can be battery powered.

The module is also able to act as a coordinator and Trust Centre through external host control. The AT style command line supplies all the tools required to set up and manage a ZigBee network by allowing easy access to the low-level functionality of the stack.

The Telegesis firmware uses the meshing and self-healing EmberZNet PRO stack to overcome many of the limitations of the tree network topology of the ZigBee 2006 stack by using the ZigBee PRO featureset.

The Telegesis firmware allows low-level access to physical parameters such as channel and power level. Parameters that define the functionality of the ETRX358x module and also allow standalone functionality are saved in non-volatile memory organised in so-called S-Registers. The SPI and I2C buses are not supported by the current firmware release, but can be used with custom firmware.

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5.1 Token Settings

The ETRX358x-LRS Series Modules' manufacturing tokens will be pre-programmed with the settings shown in the table below.

Token	Description	TG Default
MFG_CIB_OBS	Option Bytes	<not written>
MFG_CUSTOM_VERSION	Optional Version Number	<not written>
MFG_CUSTOM_EUI_64	Custom EUI	<not written>
MFG_STRING	Device Specific String	TELEGESIS
MFG_BOARD_NAME	Hardware Identifier	<Order Code>
MFG_MANUF_ID	Manufacturer ID	0x1010
MFG_PHY_CONFIG	Default Power Settings	0xFFFD
MFG_BOOTLOAD_AES_KEY	Bootloader Key	<not written>
MFG_EZSP_STORAGE	EZSP related	<not written>
MFG_CBKE_DATA	SE Security	<not written>
MFG_INSTALLATION_CODE	SE Installation	<not written>
MFG_OSC24M_BIAS_TRIM	Crystal Bias	<not written>
MFG_SYNTH_FREQ_OFFSET	Frequency offset	<not written>
MFG_OSC24M_SETTLE_DELAY	Crystal Stabilizing Time	<not written>
MFG_SECURITY_CONFIG	Security Settings	<not written>
MFG_CCA_THRESHOLD	CCA Threshold	0xFEBF
MFG_SECURE_BOOTLOADER_KEY	Secure Bootloader Key	<not written>

Table 4. Manufacturing tokens

5.2 Custom Firmware

For high volume customers the firmware can be customised on request. In addition to this the ETRX358x-LRS series of modules is an ideal platform for developing custom firmware. In order to develop custom firmware the Silicon Labs Ember toolchain is required.

When writing firmware for the ETRX358x-LRS it is important to ensure that pins PB0 and PC5 are correctly configured in order that the RF front-end module can operate correctly. An application note "Writing customised firmware for the ETRX35x-LRS" can be downloaded from the Telegesis website.

5.3 Boost Mode vs. Normal Mode

The Ember EM358x chips support a "boost mode" power setting next to the "normal mode" power setting. The "boost mode" setting increases the sensitivity and output power of the radio transceiver, however with the LRS variants enabling boost mode has no positive effect on neither the output power nor the sensitivity and therefore it is recommended to not use boost mode on this platform. The Telegesis AT Command-set firmware automatically disables boost mode on LRS series modules and adjusts the power maximum power settings.

Section 10.2 lists the requirements for the maximum power settings for use of the LRS family in different countries.

Preliminary

5.4 Software Interface

Using the default firmware the ETRX358x-LRS is controlled using a simple AT-style command interface and (mostly) non-volatile S-Registers. In order to get a full listing of all the available AT-Commands, please refer to the AT command dictionary document which corresponds to the firmware revision you intend to use.

In addition to the command dictionary there are user guides explaining the features of the firmware in more detail. If you need to find out which firmware resides on your module simply type "**ATI**" followed by a carriage return and you will be prompted with the module's manufacturing information.

The Development Kit manual describes how to upgrade the firmware either via a serial link or over the air.

Preliminary

6 Absolute Maximum Ratings

No.	Item	Symbol	Absolute Maximum Ratings	Unit
1	Supply voltage	V_{CC}	-0.3 to +3.6	Vdc
2	Voltage on any Pad	V_{in}	-0.3 to V_{CC} +0.3	Vdc
3	Voltage on any Pad pin (PA4, PA5, PB5, PB6, PB7, PC1), when used as an input to the general purpose ADC with the low voltage range selected	V_{in}	-0.3 to +2.0	Vdc
4	Storage temperature range	T_{stg}	-40 to +105	°C
5	Operating temperature range	T_{op}	-40 to +85	°C
6	Input RF level	P_{max}	+6	dBm
8	Reflow temperature	T_{Death}	Please refer to chapter 12	°C

Table 5: Absolute Maximum Ratings

The absolute maximum ratings given above should under no circumstances be violated. Exceeding one or more of the limiting values may cause permanent damage to the device.

Caution! ESD sensitive device. Precautions should be used when handling the device in order to prevent permanent damage.

6.1 Environmental Characteristics

No.	Item	Symbol	Absolute Maximum Ratings	Unit
1	ESD on any pad according to Human Body Model (HBM) circuit description	V_{THHBM}	±2	kV
2	ESD on non-RF pads according to Charged Device Model (CDM) circuit description	V_{THCDM}	±400	V
3	ESD on RF terminal (HBM)	V_{THCDM}	1000	V
4	Moisture Sensitivity Level	MSL	MSL3, per J-STD-033	

Table 6: Absolute Maximum Ratings

6.2 Recommended Operating Conditions

No.	Item	Condition / Remark	Symbol	Value			Unit
				Min	Typ	Max	
1	Supply voltage		V_{CC}	2.1	3.0	3.6	Vdc
2	RF Input Frequency		f_C	2405		2480	MHz
3	RF Input Power		p_{IN}			0	dBm
4	Operating temperature range		T_{op}	-40		+85	°C

Table 7. Recommended Operating Conditions

Preliminary

7 DC Electrical Characteristics

V_{CC} = 3.0V, T_{AMB} = 25°C, NORMAL MODE (non-Boost) unless otherwise stated

No.	Item	Condition / Remark	Symbol	Value			Unit
				Min	Typ	Max	
1	Module supply voltage		V_{CC}	2.1		3.6	Vdc
Deep Sleep Current							
2	Quiescent current, internal RC oscillator disabled,	4kB RAM retained	I_{SLEEP}		1.0		µA
3	Quiescent current, internal RC oscillator enabled	4kB RAM retained	I_{SLEEP}		1.25		µA
4	Quiescent current, including 32.768kHz oscillator	4kB RAM retained	I_{SLEEP}		1.6		µA
5	Quiescent current including internal RC oscillator and 32.768kHz oscillator	4kB RAM retained	I_{SLEEP}		1.9		µA
6	Additional current per 4kB block of RAM retained		$I_{RAMSLEEP}$		0,04		µA
Reset Current							
7	Quiescent current nReset asserted		I_{RESET}		2	3	mA
Processor and Peripheral Currents							
8	ARM® Cortex™ M3, RAM and flash memory	25°C, 12MHz Core clock	I_{MCU}		7.5		mA
9	ARM® Cortex™ M3, RAM and flash memory	25°C, 24MHz Core clock	I_{MCU}		8.5		mA
10	ARM® Cortex™ M3, RAM and flash memory sleep current	25°C, 12MHz Core clock	I_{MCU}		4.0		mA
11	ARM® Cortex™ M3, RAM and flash memory sleep current	25°C, 6MHz Core clock	I_{MCU}		2.5		mA
12	Serial controller current	Per serial controller at max. clock rate	I_{SC}		0.2		mA
13	General purpose timer current	Per timer at max. clock rate	I_{TIM}		0.25		mA
14	General purpose ADC current	Max. Sample rate, DMA	I_{ADC}		1.1		mA
15	USB Active Current		I_{USB}		1		mA
16	USB Suspend Mode Current		$I_{USBSUSP}$			2.5	mA
RX Current							
17	LNA,Radio receiver MAC and Baseband	ARM® Cortex™ M3 sleeping.	I_{RX}		26.5		mA
18	Receive current consumption	Total, 12MHz clock speed	I_{RX}		30		mA
19	Receive current consumption	Total, 24MHz clock speed	I_{RX}		31.5		mA

TX Current							
20	Transmit current consumption	at +20dBm module output power	I_{TXVCC}		140		mA
21	Transmit Current consumption	at min module output power	I_{TXVCC}		52		mA
Sleep Modes & Peripheral Current							
22	MCU, RAM and flash, FEM, radio off	12MHz clock speed	I_{MCU}		7		mA
23	MCU, RAM and flash, FEM, radio off	24MHz clock speed	I_{MCU}		8		mA
24	Serial Controller	Max data rate	I_{SC}		0.2		mA
25	Timer	Max clock rate	I_{TMR}		0.25		mA
26	ADC	Max sample rate	I_{ADC}		1.1		mA

Table 8: DC Electrical Characteristics

Preliminary

8 Digital I/O Specifications

The digital I/Os of the ETRX358x-LRS module have the ratings shown below.

V_{CC} = 3.0V, T_{AMB} = 25°C, NORMAL MODE unless otherwise stated

No.	Item	Condition / Remark	Symbol	Value			Unit
				Min	Typ	Max	
1	Low Schmitt switching threshold	Schmitt input threshold going from high to low	V_{SWIL}	0.42 x V_{CC}		0.5 x V_{CC}	Vdc
2	High Schmitt switching threshold	Schmitt input threshold going from low to high	V_{SWIH}	0.62 x V_{CC}		0.8 x V_{CC}	MHz
3	Input current for logic 0		I_{IL}			-0.5	µA
4	Input current for logic 1		I_{IH}			0.5	µA
5	Input Pull-up resistor value		R_{IPU}	24	29	34	kΩ
6	Input Pull-down resistor value		R_{IPD}	24	29	34	kΩ
7	Output voltage for logic 0	I_{OL} = 4mA (8mA) for standard (high current) pads	V_{OL}	0		0.18 x V_{CC}	V
8	Output voltage for logic 1	I_{OH} = 4mA (8mA)for standard (high current) pads	V_{OH}	0.82 x V_{CC}		V_{CC}	V
9	Output Source Current	Standard current pad	I_{OHS}			4	mA
10	Output Sink current	Standard current pad	I_{OLS}			4	mA
11	Output Source Current	High current pad (1)	I_{OHH}			8	mA
12	Output Sink current	High current pad (1)	I_{OLH}			8	mA
13	Total output current		I_{OH} + I_{OL}			40	mA

Table 9. Digital I/O Specifications

No.	Item	Condition / Remark	Symbol	Value			Unit
				Min	Typ	Max	
1	Low Schmitt switching threshold	Schmitt input threshold going from high to low	V_{SWIL}	0.42 x V_{CC}		0.5 x V_{CC}	Vdc
2	High Schmitt switching threshold	Schmitt input threshold going from low to high	V_{SWIH}	0.62 x V_{CC}		0.68 x V_{CC}	Vdc
3	Input current for logic 0		I_{IL}			-0.5	µA
4	Input current for logic 1		I_{IH}			0.5	µA
5	Input Pull-up resistor value	Chip not reset	R_{IPU}	24	29	34	kΩ
6	Input Pull-up resistor value	Chip reset	$R_{IPURESET}$	12	14.5	17	kΩ

Table 10. nReset Pin Specifications

Notes

1) High current pads are PA6, PA7, PB6, PB7, PC0

9 A/D Converter Characteristics

The ADC is a first-order sigma-delta converter. For additional information on the ADC please refer to the EM358x datasheet.

No.	Item	
1	A/D resolution	Up to 14 bits
2	A/D sample time for 7-bit conversion	5.33µs (188kHz)
3	A/D sample time for 14-bit conversion	682µs
4	Reference Voltage	1.2V

Table 11. A/D Converter Characteristics

10 AC Electrical Characteristics

V_{CC} = 3.0V, T_{AMB} = 25°C, NORMAL MODE measured at 50Ω terminal load connected to the U.FL socket

No.	Receiver	Value			Unit
		Min	Typ	Max	
1	Frequency range	2400		2500	MHz
2	Sensitivity for 1% Packet Error Rate (PER)	-107	-106	-100	dBm
4	Saturation (maximum input level for correct operation)	-3	2		dBm
5	High-Side Adjacent Channel Rejection (1% PER and desired signal –82dBm acc. to [1])		41		dB
6	Low-Side Adjacent Channel Rejection (1% PER and desired signal –82dBm acc. to [1])		40		dB
7	2nd High-Side Adjacent Channel Rejection (1% PER and desired signal –82dBm acc. to [1])		54		dB
8	2nd Low-Side Adjacent Channel Rejection (1% PER and desired signal –82dBm acc. to [1])		52		dB
9	Channel Rejection for all other channels (1% PER and desired signal –82dBm acc. to [1])		tbd		dB
10	802.11g rejection centred at +12MHz or –13MHz (1% PER and desired signal –82dBm acc. to [1])		tbd		dB
11	Co-channel rejection (1% PER and desired signal –82dBm acc. to [1])		tbd		dBc
12	Relative frequency error (2x40ppm required by [1])	-120		120	ppm
13	Relative timing error (2x40ppm required by [1])	-120		120	ppm
14	Linear RSSI range	35			dB
15	Output power at highest power setting NORMAL MODE BOOST MODE	 20 20	 21 21	 21.5 21.5	dBm
16	Output power at lowest power setting			-40	dBm
17	Error vector magnitude as per IEEE802.15.4		7	15	%
18	Carrier frequency error	-40		40	ppm

Table 12. AC Electrical Characteristics

Please Note: For the relationship between EM358x power settings and module output power please relate to chapter 10.1 of this document. When developing custom firmware the output power settings described in this document relate directly to the EM358x power settings accessible via the Ember stack API. When using the Telegesis AT Command-set firmware the settings

mentioned in this document directly relate to the settings in the S-Register S01 which is used for setting the output power.

No.	Synthesiser Characteristics	Limit			Unit
		Min	Typ	Max	
22	Frequency range	2400		2500	MHz
23	Frequency resolution		11.7		kHz
24	Lock time from off state, with correct VCO DAC settings			100	µs
25	Relock time, channel change or Rx/Tx turnaround			100	µs
26	Phase noise at 100kHz offset		-71dBc/Hz		
27	Phase noise at 1MHz offset		-91dBc/Hz		
28	Phase noise at 4MHz offset		-103dBc/Hz		
29	Phase noise at 10MHz offset		-111dBc/Hz		

Table 13. Synthesiser Characteristics

No.	Power On Reset (POR) Specifications	Limit			Unit
		Min	Typ	Max	
30	V_{CC} POR release	0.62	0.95	1.2	Vdc
31	V_{CC} POR assert	0.45	0.65	0.85	Vdc

Table 14. Power On Reset Specifications

No.	nRESET Specifications	Limit			Unit
		Min	Typ	Max	
32	Reset Filter Time constant	2.1	12	16	µs
33	Reset Pulse width to guarantee a reset	26			µs
34	Reset Pulse width guaranteed not to cause reset	0		1	µs

Table 15. nReset Specifications

Preliminary

10.1 TX Power Characteristics

The diagrams below show the typical output power and module current in dependency on EM358x-LRS power setting in NORMAL MODE at 3.0V and room temperature.

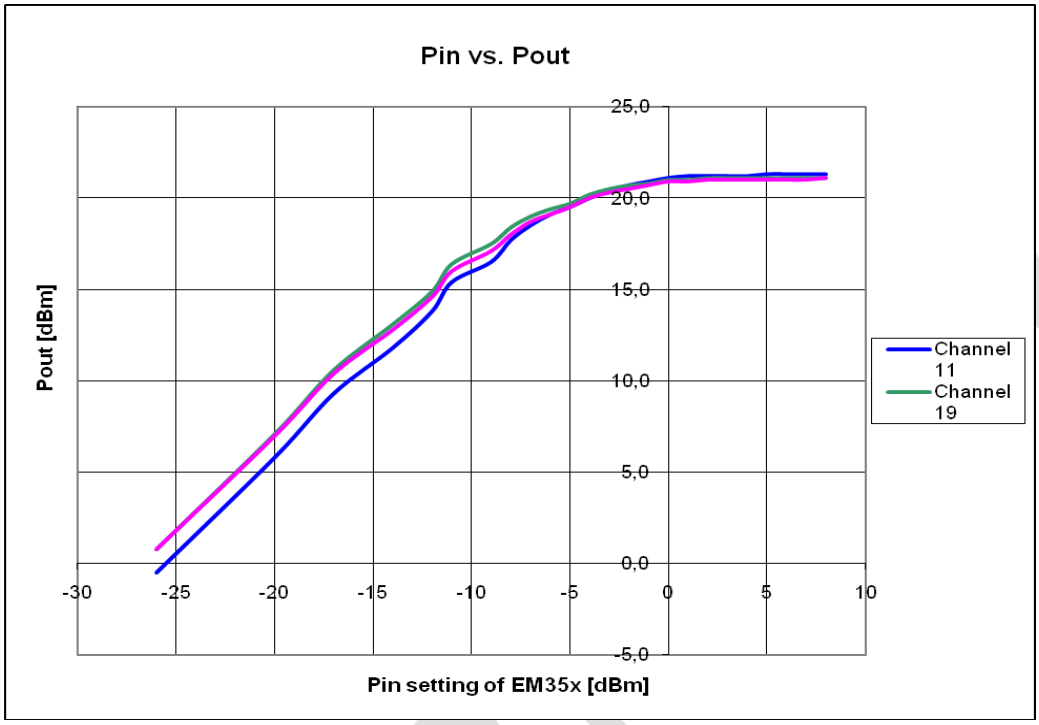

Figure 3. Output Power vs. Power Setting

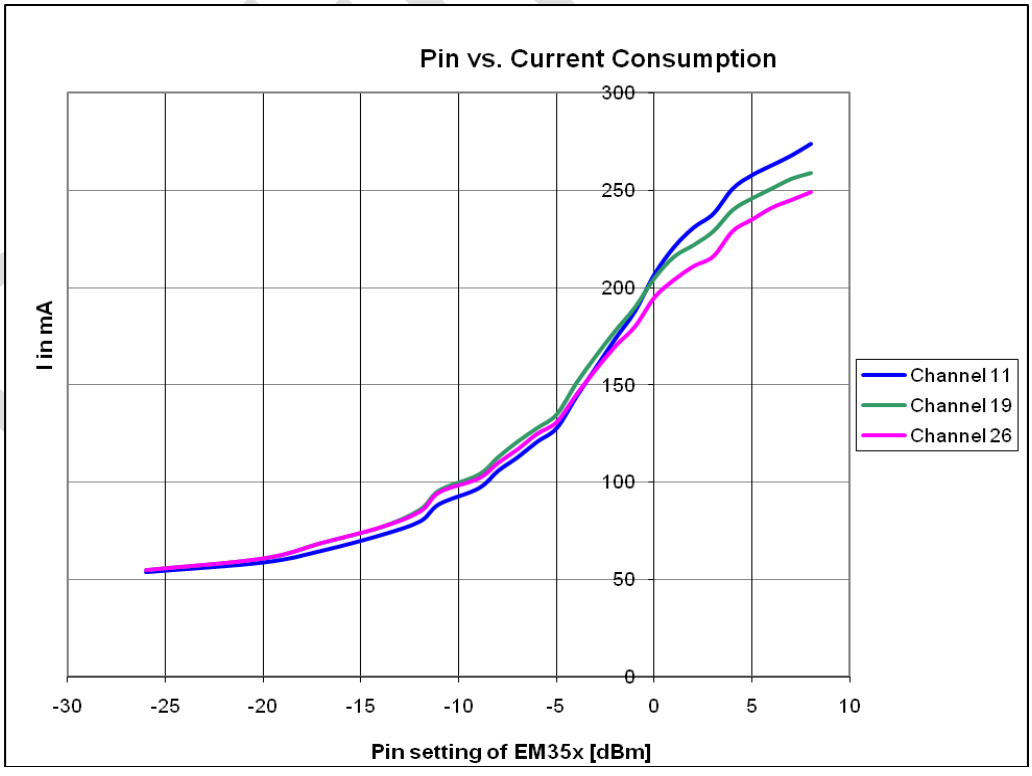

Figure 4. Module Current vs. Power Setting

10.2 Power Settings for Regulatory Compliance

Because of the high gain of the frontend module output power of up to 22dBm can be achieved When the antenna gain is included the output power of the EM358x transceivers needs to be reduced for regulatory compliance. The following tables list the maximum permitted power setting for the antenna types listed in Table 2. Note that this is the power out of the EM358x chip (set in register S01 when using Telegesis R3xx firmware), and the power delivered to the antenna will be higher by the gain of the RF power amplifier.
(V_{CC} = 3.0V, T_{AMB} = 25°C, NORMAL MODE)

Antenna	Channels 11-18	Channels 19-24	Channel 25	Channel 26
1/2 Wave	tbd	tbd	tbd	tbd
1/4 Wave	tbd	tbd	tbd	tbd
On Board	tbd	tbd	tbd	tbd

Table 16: Maximum Power Settings for European Compliance

Finally Table 17 lists the maximum Power settings for FCC and IC compliance.

Antenna	Channels 11-18	Channels 19-24	Channel 25	Channel 26
1/2 Wave	tbd	tbd	tbd	tbd
1/4 Wave	tbd	tbd	tbd	tbd
On Board	tbd	tbd	tbd	tbd

Table 17: Maximum Power Settings for FCC, IC Compliance

Preliminary

10.3 Temperature behaviour

Figure 5 and Figure 6 illustrate the temperature behaviour of the ETRX358x-LRS series of modules. Please note that although the temperature behaviour was measured to up to 100 degrees Celsius the absolute maximum rating is 85 degrees Celsius.

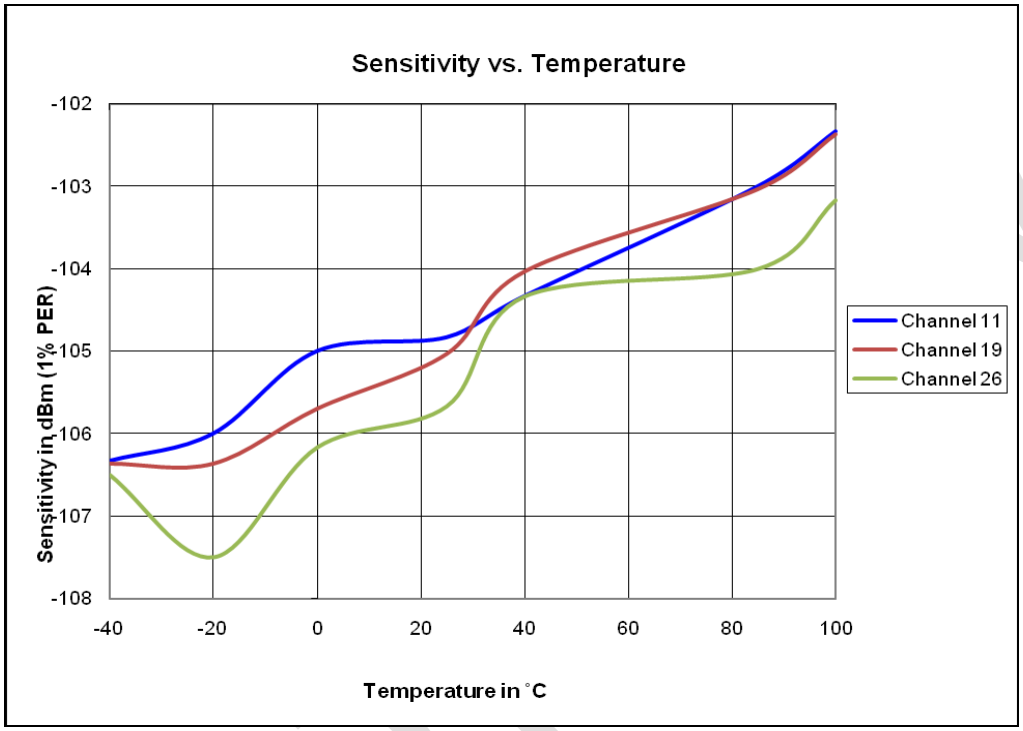

Figure 5. Sensitivity vs. Temperature

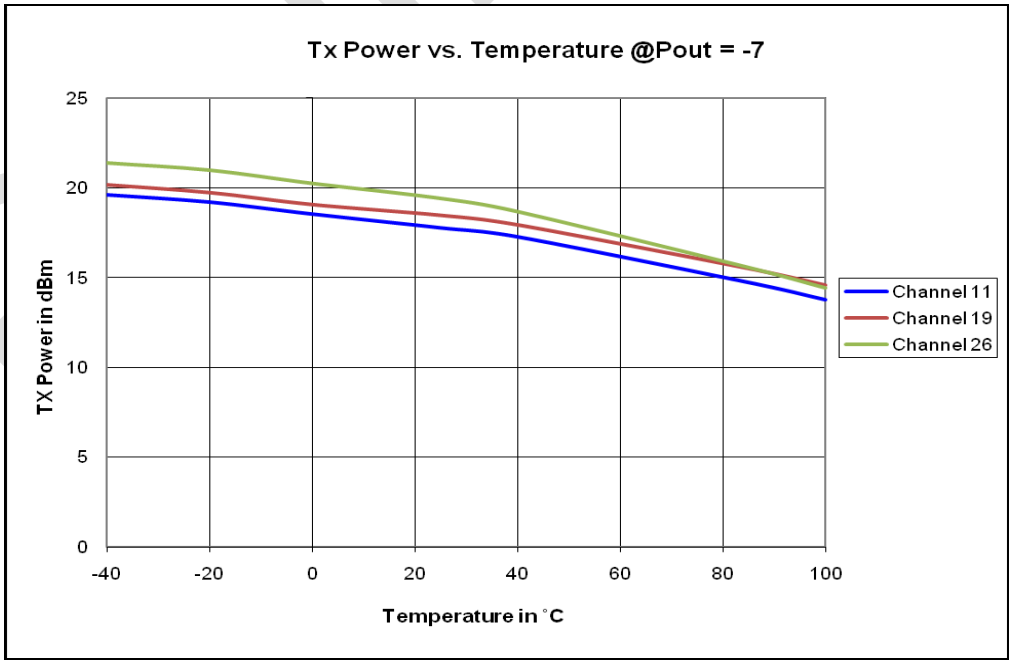

Figure 6. TX Power vs. Temperature

11 Physical Dimensions

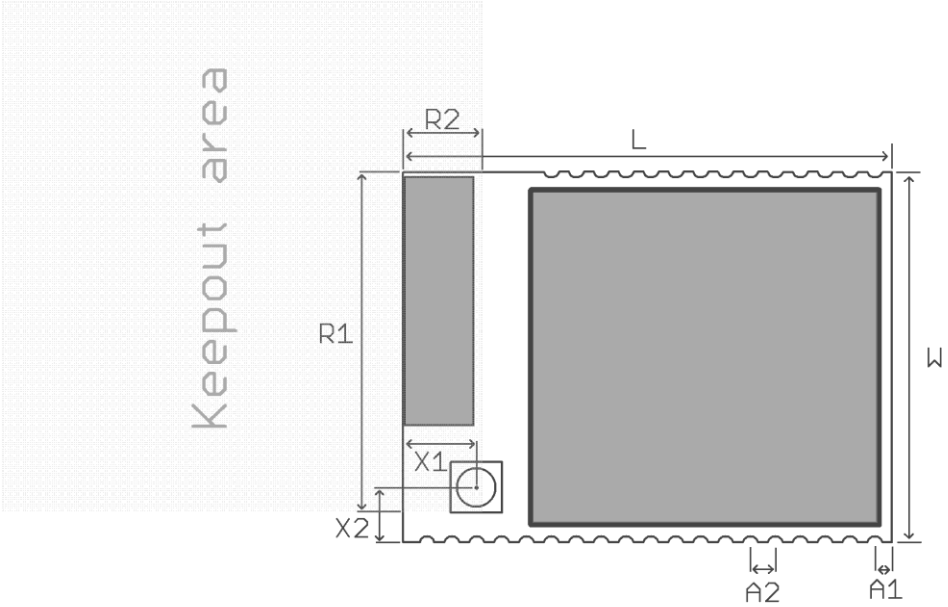

Figure 7. ETRX3 Physical Dimensions

Symbol	Explanation	Distance
L	Length of the module	25.0mm
W	Width of the module	19.0mm
H	Height of the module	3.8mm
A1	Distance centre of pad PCB edge	0.9mm
A2	Pitch	1.27mm
R1	Keep-out Zone from corner of PCB	17.5mm
R2	Keep-out Zone from corner of PCB	4.1mm
X1	Distance centre of Antenna connector PCB edge	3.8mm
X2	Distance centre of Antenna connector PCB edge	2.8mm

Table 18. ETRX3 Physical Dimensions

For ideal RF performance when using the on-board antenna, the antenna should be located at the corner of the carrier PCB. There should be no components, tracks or copper planes in the "keep-out" area which should be as large as possible. When using the U.FL RF connector the "keep-out" area does not have to be kept. **NB**: The modules' transmit/receive range will depend on the antenna used and also the housing of the finished product.

12 Recommended Reflow Profile

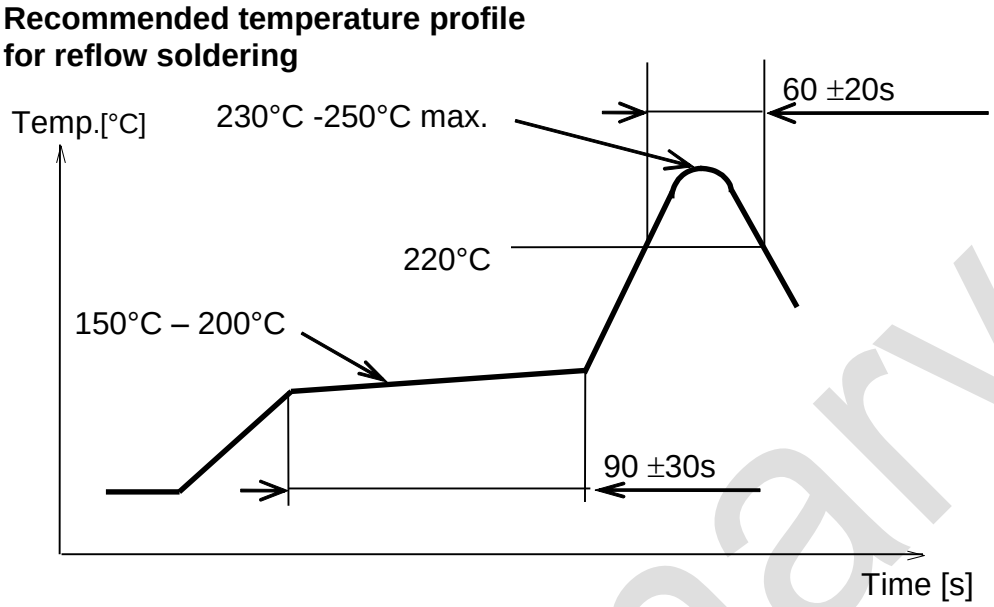

Figure 8. Recommended Reflow Profile

Use of "No-Clean" solder paste is recommended to avoid the requirement for a cleaning process. Cleaning the module is strongly discouraged because it will be difficult to ensure no cleaning agent and other residuals are remaining underneath the shielding can as well as in the gap between the module and the host board.

Please Note:
Maximum number of reflow cycles: 2
Opposite-side reflow is prohibited due to the module's weight. (i.e. you must not place the module on the bottom / underside of your PCB and re-flow).

Preliminary

13 Product Label Drawing

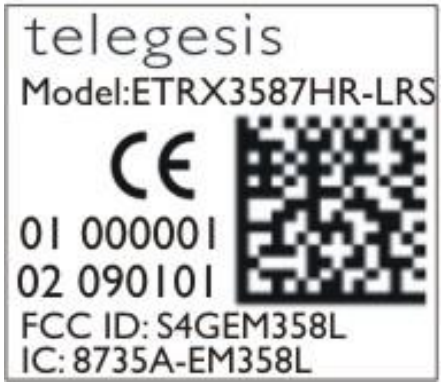

Figure 9. Product Label

The label dimensions are 16mm x 14 mm. The label will withstand temperatures used during reflow soldering. The characters “HR” are only present on the versions with the Hirose connector,

Imprint	Description
ETRX3587HR-LRS	Module Order code Possible codes are: - ETRX3581-LRS - ETRX3581HR-LRS - ETRX3582-LRS - ETRX3582HR-LRS - ETRX3585-LRS - ETRX3585HR-LRS - ETRX3586-LRS - ETRX3586HR-LRS - ETRX3587-LRS - ETRX3587HR-LRS - ETRX3588-LRS - ETRX3588HR-LRS
000001	Indication for the serial number.
090101	Production Date Code in the format YYMMDD, e.g. 090602
01	Indication for factory ID
02	Indication for the hardware revision
FCC ID: S4GEM358L	FCC ID code for this product
IC: 8735A-EM358L	The IC ID
CE	The CE Mark
2D-Barcode	Information in the 2D-Barcode are the serial number [6 characters], the Part-Order code, identifier for the batch number [2 characters], the identifier for the hardware release [2 characters] and the production date code in the format Year-Month-Day [6 characters], all separated by a semicolon.

Table 19. ETRX358x-LRS Label Details

Preliminary

14 Recommended Footprint

In order to surface mount an ETRX3 series module, we recommend that you use pads which are 1mm wide and 1.2mm high. Unless using the “HR” variants the “keep-out” zone shown in section 11 must be retained, and it must be ensured that this area is free of copper tracks and/or copper planes/layers.

You must also ensure that there is no exposed copper on your layout which may contact with the underside of the ETRX3 series module.

For best RF performance it is required to provide good ground connections to the ground pads of the module. It is recommended to use multiple vias between each ground pad and a solid ground plane to minimize inductivity in the ground path.

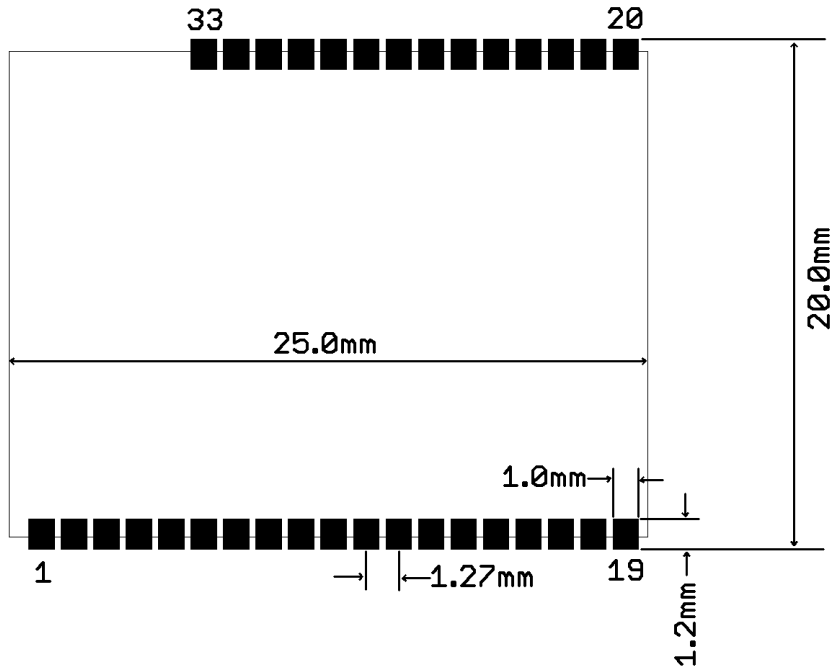

Figure 10. Recommended Footprint

The land pattern dimensions above serve as a guideline.

We recommend that you use the same pad dimensions for the solder paste screen as you have for the copper pads. However these sizes and shapes may need to be varied depending on your soldering processes and your individual production standards. We recommend a paste screen thickness of 120µm to 150µm.

Figure 11 shows the typical pad dimensions of the module and Figure 12-Figure 14 in section 14.1 show examples of how to align the module on its host PCB.

Although the undersides of the ETRX3 series modules are fully coated, no exposed copper, such as through-hole vias, planes or tracks on your board component layer, should be located below the ETRX3 series module in order to avoid 'shorts'. All ETRX3 series modules use a multilayer PCB containing an inner RF shielding ground plane, therefore there is no need to have an additional copper plane directly under the ETRX3 series module.

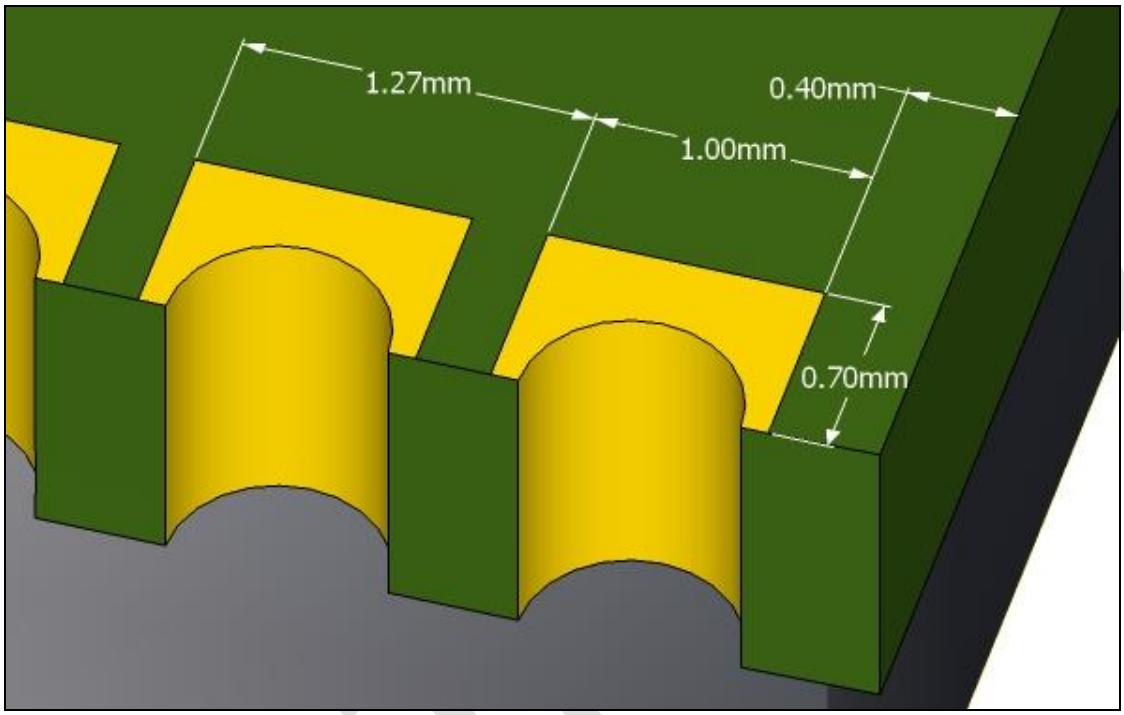

Figure 11. Typical pad dimensions

Finally it is recommended to use no clean flux when soldering the ETRX358x family of modules and to not use a washing process after reflow. If the process does require washing then care must be taken that no washing agent is trapped underneath the shielding can after the drying process has completed.

Preliminary

14.1 Recommended Placement

When placing the module please either locate the antenna in the corner as shown in Figure 12 so that the recommended antenna keepout zone is being followed, or add a no copper zone as indicated in Figure 14.

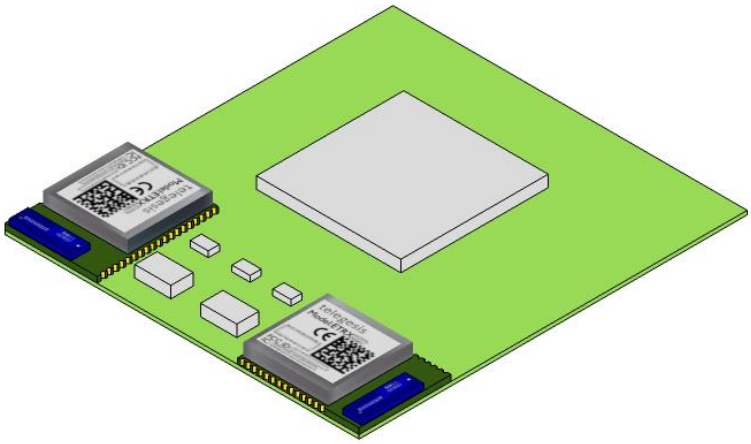

Figure 12. Typical placement

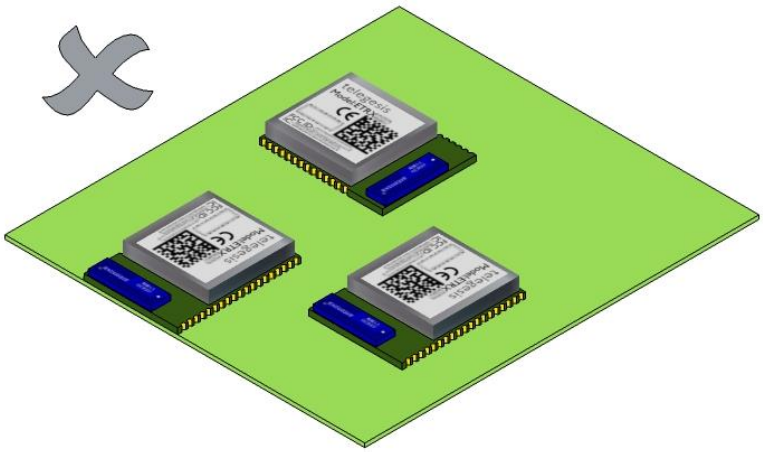

Figure 13. How to not place the Module

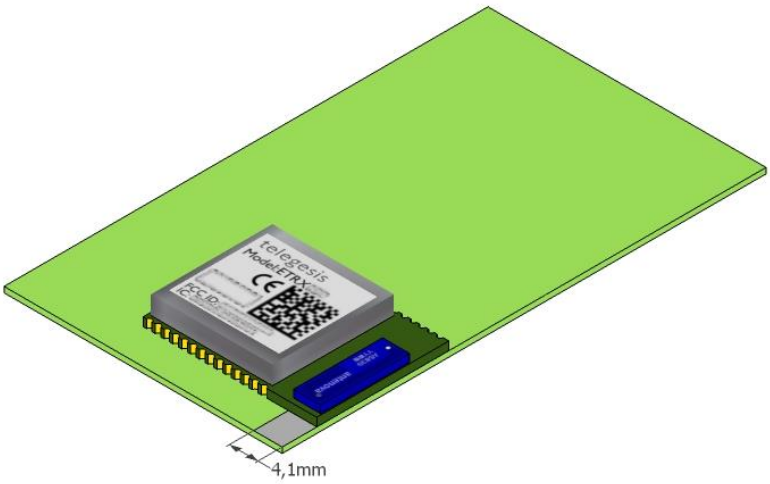

Figure 14. Adding a no copper / no component area

Preliminary

14.2 Example carrier board

Since the RF performance of the module with the on board antenna is strongly dependent on the proper location of the module on its carrier board, **Error! Reference source not found.**17 shows the reference carrier board which was used during testing by Telegesis.

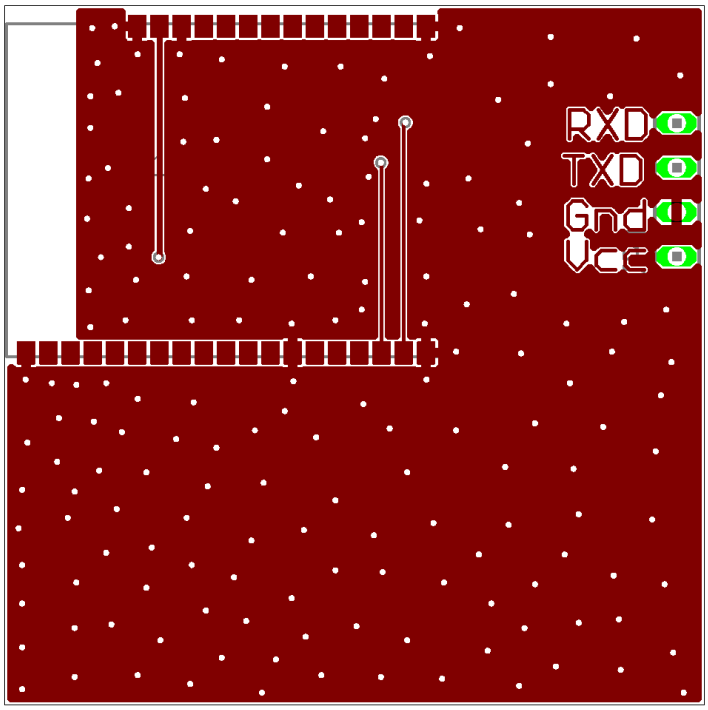

Figure 17: Reference Board

For best performance it is recommended to locate the antenna towards the corner of the carrier board and to respect the recommended keep-out areas as described in section 11.

Finally to provide a good reference ground to the on board antenna, the carrier board should have a ground plane spanning no less than 40 x 40mm. In many cases a smaller ground plane will suffice, but a degradation in radio performance could be the result.

Preliminary

15 Reliability Tests

The following measurements will be conducted after the module has been exposed to standard room temperature and humidity for 1 hour.

No	Item	Limit	Condition
1	Vibration test	Electrical parameter should be in specification	Freq.:40Hz,Amplitude:1.5mm 20min. / cycle,1hrs. each of X and Y axis
2	Shock test	the same as the above	Dropped onto hard wood from height of 50cm for 10 times
3	Heat cycle test	the same as the above	-40°C for 30min. and +85°C for 30min.; each temperature 300 cycles
5	Low temp. test	the same as the above	-40°C, 300h
6	High temp. test	the same as the above	+85°C, 300h

Table 20: Reliability Tests

16 Application Notes

16.1 Safety Precautions

These specifications are intended to preserve the quality assurance of products as individual components.

Before use, check and evaluate their operation when mounted on your products. Abide by these specifications when using the products. These products may short-circuit. If electrical shocks, smoke, fire, and/or accidents involving human life are anticipated when a short circuit occurs, then provide the following failsafe functions as a minimum:

(1) Ensure the safety of the whole system by installing a protection circuit and a protection device.

(2) Ensure the safety of the whole system by installing a redundant circuit or another system to prevent a single fault causing an unsafe status.

16.2 Design Engineering Notes

(1) Heat is the major cause of shortening the life of these products. Avoid assembly and use of the target equipment in conditions where the product's temperature may exceed the maximum allowable.

(2) Failure to do so may result in degrading of the product's functions and damage to the product.

(3) If pulses or other transient loads (a large load applied in a short time) are applied to the products, before use, check and evaluate their operation when assembled onto your products.

(4) These products are not intended for other uses, other than under the special conditions shown below. Before using these products under such special conditions, check their performance and reliability under the said special conditions carefully, to determine whether or not they can be used in such a manner.

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(5) In liquid, such as water, salt water, oil, alkali, or organic solvent, or in places where liquid may splash.

(6) In direct sunlight, outdoors, or in a dusty environment

(7) In an environment where condensation occurs.

(8) In an environment with a high concentration of harmful gas (e.g. salty air, HCl, Cl2, SO2, H2S, NH3, and NOx)

(9) If an abnormal voltage is applied due to a problem occurring in other components or circuits, replace these products with new products because they may not be able to provide normal performance even if their electronic characteristics and appearances appear satisfactory.

(10) Mechanical stress during assembly of the board and operation has to be avoided.

(11) Pressing on parts of the metal cover or fastening objects to the metal cover is not permitted.

16.3 Storage Conditions

(1) The module must not be stressed mechanically during storage.

(2) Do not store these products in the following conditions or the performance characteristics of the product, such as RF performance, may well be adversely affected:

(3) Storage in salty air or in an environment with a high concentration of corrosive gas, such as Cl2, H2S, NH3, SO2, or NOX

(4) Storage (before assembly of the end product) of the modules for more than one year after the date of delivery at your company even if all the above conditions (1) to (3) have been met, should be avoided.

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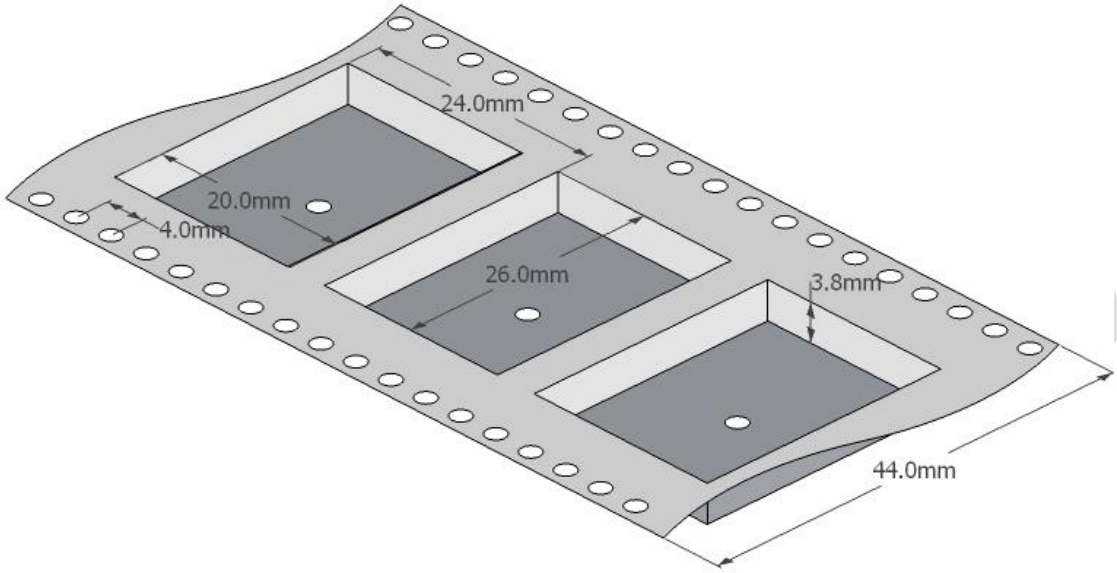
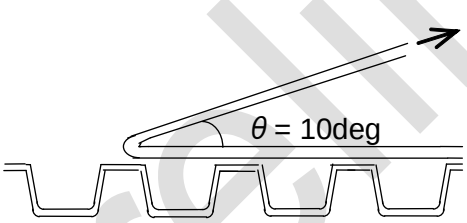
17 Packaging

17.1 Embossed Tape

(1) Dimension of the tape



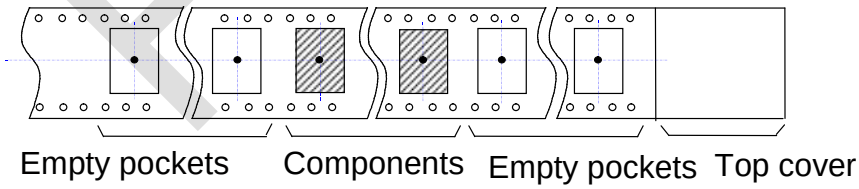
(2) Cover tape peel force



Speed = 300mm/min.

Cover tape peel force
=0.098～0.68N (10～70g)

(3) Empty pockets



NB: Empty pockets in the component packed area will be less than two per reel and those empty pockets will not be consecutive.

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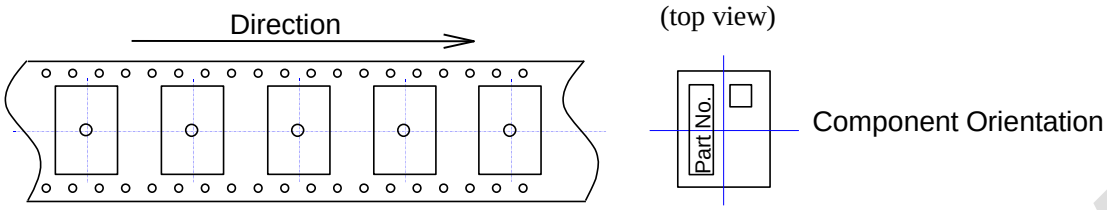
17.2 Component Orientation

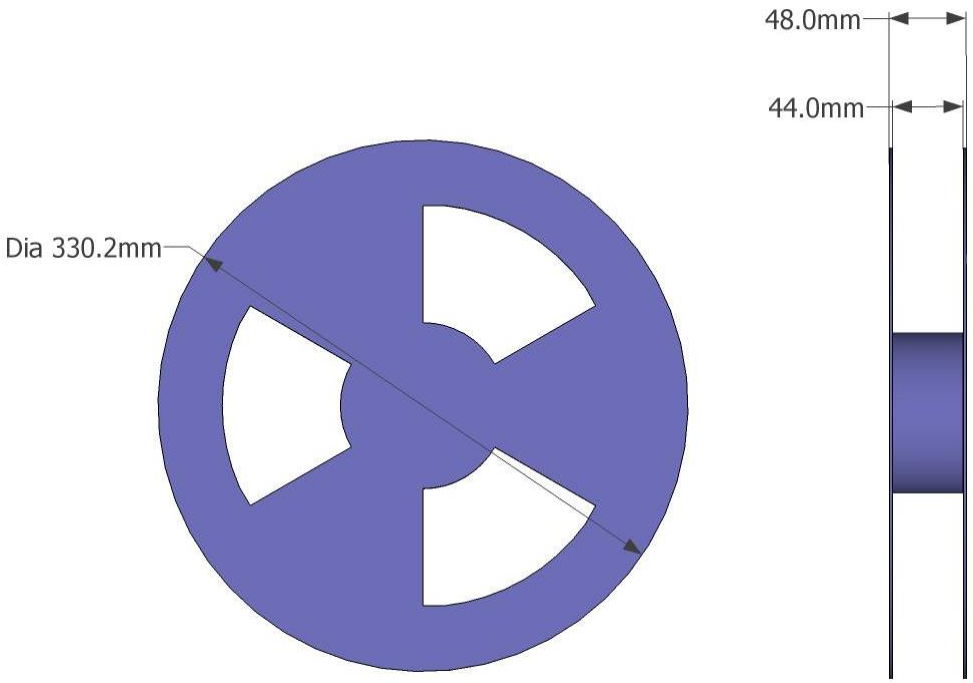
Top cover tape will not obstruct the carrier tape holes and will not extend beyond the edges of the carrier tape



17.3 Reel Dimensions

(4) Quantity per reel: 600 pieces

(5) Marking: Part No. / Quantity / Lot No. and manufacturer part# with bar-code will be on the reel



17.4 Packaging

(6) Each reel will be packed in a hermetically-sealed bag

(7) Marking: Reel / Antistatic Packaging / Reel Box and outer Box will carry the following label

Imprint	**Description**
MFG P/N: 99X902DL	Internal use
Lot: 00	Internal use
P/N:ETRX3587-LRS	Telegesis Module Order Code.
Quantity:600	Quantity of modules inside the reel/carton
Reel No: 000001	Six digit unique Reel number counting up from 000001
Date:120824	Date Code in the format YYMMDD, e.g. 120824
P/C: ETRX3587-LRS-R308	Module product code with reference to firmware/module type selected during ATE. If needed multiline.
2D-Barcode	Information in the 32x32 Datamatrix 2D-Barcode are and identifier “!REEL” [5 characters], the reel number [6 characters], the Module Order code [max 18 characters], the quantity [max 4 characters] , the date code in the format Year-Month-Day [6 characters] and the product code [max 40 characters] , all separated by a semicolon.

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18 Ordering Information

Ordering/Product Code	Description
ETRX3581-LRS[2] ETRX3582-LRS[2] ETRX3585-LRS[2] ETRX3586-LRS[2] **ETRX3587-LRS** ETRX3588-LRS[2]	Power amplified Telegesis Wireless Mesh Networking Module with Silicon Labs ZigBee Technology: • Based on Silicon Labs EM358x SoC • Telegesis AT Style Command Interpreter based on • EmberZNet meshing and self-healing ZigBee PRO stack • Integrated 2.4GHz Antenna
ETRX3581HR-LRS[2] ETRX3582HR-LRS[2] ETRX3585HR-LRS[2] ETRX3586HR-LRS[2] **ETRX3587HR-LRS** ETRX3588HR-LRS[2]	Power amplified Telegesis Wireless Mesh Networking Module with Silicon Labs ZigBee Technology: • Based on Silicon Labs EM358x SoC • Telegesis AT Style Command Interpreter based on • EmberZNet meshing and self-healing ZigBee PRO stack • U.FL coaxial Antenna Connector
ETRX357DVK	Telegesis Development Kit with: • 3 x ETRX3DVK Development Boards • 3 x USB cables • 2 x ETRX357 on carrier boards • 2 x ETRX357HR on carrier boards • 2 x ETRX357-LRS on carrier boards • 2 x ETRX357HR-LRS on carrier boards • 1 x ETRX3USB USB stick • 2 x ½-wave antennae • 2 x ¼-wave antennae
ETRX3587 Expansion Pack	• 2 x ETRX3587 on carrier boards • 2 x ETRX3587HR on carrier boards • 2 x ETRX3587-LRS on carrier boards • 2 x ETRX3587HR-LRS on carrier boards

Notes:

- Customers' PO's must state the Ordering/Product Code.
- There is no "blank" version of the ETRX358x modules available. All Modules are pre-programmed with the Telegesis AT style command interpreter based on the EmberZNet stack. (In case it is desired to program custom firmware the pre-programmed firmware can simply be overwritten).

[2] MOQ and Lead Time applies. Only stocked modules are ETRX3587 and ETRX3587HR

19 Trademarks

All trademarks, registered trademarks and products names are the sole property of their respective owners.

20 Disclaimer

Product and company names and logos referenced may either be trademarks or registered trademarks of their respective companies. We reserve the right to make modifications and/or improvements without prior notification. All information is correct at time of issue. Telegesis (UK) Ltd does not convey any license under its patent rights or assume any responsibility for the use of the described product

21 RoHS Declaration

Declaration of environmental compatibility for supplied products:

Hereby we declare to our best present knowledge based on the declaration of our suppliers that this product does not contain any of the substances which are banned by Directive 2011/65/EU (RoHS)

22 Data Sheet Status

Telegesis (UK) Ltd. reserves the right to change the specification without notice, in order to improve the design and supply the best possible product. Please consult the most recently issued data sheet before initiating or completing a design.

23 Life Support Policy

This product is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Telegesis (UK) Ltd. for any damages resulting.

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24 Related Documents

[1] IEEE Standard 802.15.4 –2003 Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks (LR-WPANs)

[2] Datasheet EM35x, Ember. (www.ember.com)

[3] Datasheet U.FL-Series 2004.2 Hirose Ultra Small Surface Mount Coaxial Connectors - Low Profile 1.9mm or 2.4mm Mated Height

[4] The ZigBee specification (www.zigbee.org)

[5] Specification for Antenova Rufa Antenna (www.antenova.com)

[6] Embedded Antenna design Ltd. (EAD Ltd.) (www.ead-ltd.com)

25 Contact Information

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